

UNIVERSITY OF PENNSYLVANIA

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THE TRIAS OF YORK COUNTY,
PENNSYLVANIA**

HENRY E. WANNER

A THESIS

IN GEOLOGY

**PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
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SOME ADDITIONAL FAUNAL REMAINS FROM THE TRIAS OF YORK COUNTY, PENNSYLVANIA

By H. E. WANNER.

A paper on the Triassic fauna of York County, Pennsylvania, was published in 1921.¹ Since then research work in the same field has been carried on by the author as continuously as time permitted. The purpose of this investigation was the location of some layers in the York County Trias that might be productive of faunal remains and to secure material that would serve as an acceptable contribution to the knowledge of the paleontology of the Newark system. The additional faunal remains discovered are considered to be of sufficient importance to justify their presentation in this report.

This work was completed at the University of Pennsylvania under the direction of Dr. F. Ehrenfeld, for whose instruction and advice, I desire to express my appreciation. I am indebted to Dr. H. A. Pilsbry for his friendly counsel and assistance; to him also belongs the credit for the identification and description of the mollusca. Dr. W. D. Matthew kindly gave me access to the collection from the Trias of eastern North America in the American Museum of Natural History, New York.

The summers of 1925 and 1926 were largely spent in the field. Outcrops where the rocks were exposed in quarries or along streams and roads, however slight, were systematically searched and examined. The discovery of fossil bearing strata along the Little Conewago creek materially aided the search. Exposures of this same rock material, a hard calcareous sandstone, were carefully sought and where found proved productive. This rock when freshly broken had a fetid, or somewhat phosphatic odor.

The region covered in this paper, located in the Middletown Quadrangle, U. S. Geological Survey, comprises that part of the Trias southwest of the Susquehanna river and south of the Conewago hills. This portion of the Piedmont plateau is in the physiographic province known as the Triassic Lowland, and is enclosed

¹ H. E. Wanner. Some Faunal Remains from the Trias of York County, Pennsylvania. Acad. Nat. Sci. Proc., Part I. Phila., 1921.

between the tip of the Carlisle prong and the Trenton prong; two of the crystalline extensions of the older Appalachians.

The drainage of the area is good. No swamps or low lands are present. The master stream, the Big Conewago creek, flows northeast and is tributary to the Susquehanna river. The country is a rolling plain, four hundred feet or more above sea level. The elevation to the north, the Conewago hills, marks the diabase intrusion. This trap ridge crosses the Susquehanna at York Haven. The relief of the region south of these hills is uniformly slight. This terrain was reduced to a peneplain during the Tertiary. The trap ridges withstood this peneplanation much better than the softer shales and sandstones to the south. They remained as elevations standing in bold relief on the old peneplain. The incised meanders of the Conewago creeks are expressive evidence of the subsequent uplift of the Tertiary peneplain.

The residual covering, classified as Penn soil, by the U. S. Department of Agriculture, was produced by the weathering of the Triassic sandstones and shales. An abundance of rounded pebbles marks the outcrop of conglomerate layers. The resulting soil is known locally as gravel land. The soil cap on the steeper hillsides is sometimes penetrated by an exposure of the harder rock layers. Occasionally some blocks of the more resistant rocks remain as erosion remnants.

Since a great part of the underlying rock layers are concealed by the soil cap, the complete stratigraphy of this region is as yet an unsolved problem.

Most of the rocks dip northwest at an angle from 15 to 24 degrees. The section following represents the strata, intermittently exposed, between two horizons of the fossil bearing beds (locs. 3 and 5). The rapid alternation of the sediments and the presence of unaltered feldspar and mica in them is significant. It shows the rapidly changing conditions under which this continental sedimentation took place.

Further up the Little Conewago (loc. 6) still lower in the Geological column, is another horizon of fossil bearing sandstone. Here there are two small lenses included in the strata. The one directly superimposed above the other. The lower lens has a length of 30 feet and a maximum thickness of 9 inches. The upper is 21

Rock Character	Thickness in feet	Fossil content
Gray micaceous sandstone.....		
Green shale.....	1.4	
Black shale.....	1.6	Estheria, Candona, ganoid scales.
Calcareous sandstone ¹	.5	Reptilian jaw, copro- lites.
Gray micaceous sandstone.....	6.5	
Light green micaceous shale.....	9.0	
Argillaceous sandstone.....	6.1	
Compact sandstone.....	2.2	
(Concealed), probably shale.....	60.0	
Reddish gray sandstone.....	8.5	
(Concealed), probably shale.....	10.0	
Micaceous sandstone.....	4.0	
(Concealed), probably shale.....	100.0	
Micaceous sandstone.....	2.0	
(Partly concealed), red and green.. shale.....	3.0	
Friable red shale.....	1.4	
Greenish gray shale.....	2.0	Diplodon, Ctenophyl- lum.
Friable red shale ²	6.0	Casts of mollusks.
Calcareous sandstone ¹	1.0	Reptilian teeth, ganoid scales.
Red shale		

¹ Marks fossil bearing calcareous sandstone.

² Only the layer of red shale immediately in contact with the green shale contained the casts of mollusks.

feet long with a thickness of 10 inches. The termination of one end of the lower lens is at the axis of a small anticlinal fold. This was the only case of folding noticed in the field covered. A small section through this exposure follows:—

Rock Character	Thickness in inches	Fossil content
Shale		
(1st lens) Calcareous sandstone ¹	10	Reptilian teeth.
Shale	8	Ctenophyllum.
Compact red sandstone	8	
(2nd lens) Calcareous sandstone ¹	9	Reptilian rib, teeth, ganoid scales.
Friable red shale	24	
Sandstone		

¹Marks fossil bearing calcareous sandstone.

Both lenses run out into shales. They represent a rapid inwash of material, both faunal and floral, into small bodies of water followed by a quick covering, or silting up, with sand or mud. The calcium carbonate content of this rock is given later in the chemical analyses.

Numerous casts of limbs, some measuring over 15 cm. in length and 6 cm. in diameter, were found in a cultivated field, sloping away from the Little Conewago creek. As there was no rock exposure here the matrix could not be located. Where the last section terminated along the Little Conewago creek, drift blocks of sandstone, so lightly worn as to show that they were derived from nearby strata, contained moulds of the stems of plants.

A prominent feature of the local Trias, whether containing productive fossil layers, or not, is the striking predominance of red friable shales. These weather with great rapidity and furnished the major part of the soil mantle.

In general, geologists now regard the theory of continental origin of the beds of the Newark System as definitely proven.^{2 3 4}

² I. C. Russell. The Newark System. U. S. Geol. Survey, Bull. 85, Chapter V, 1892.

³ W. M. Davis. The Triassic formation of Connecticut. U. S. Geol. Survey, 18th Ann. Rept., pp. 32-34, 1898.

⁴ J. Barrell. Relations between climatic and terrestrial deposits. Jour. Geol. vol. XVI, pp. 182, 259, 1908.

From the floral remains the Triassic rocks of York County are placed by Fontaine in the Upper Trias and correlated with the Rhetic of Bavaria.⁵ Lull, from the faunal remains of the Connecticut valley, states that "the Newark System may bridge the time between the Triassic and Jurassic."⁶

The presence of at least eight different fresh-water mollusca in the York County Trias is indicative of fresh rather than saline-water conditions. The carbonaceous black shale containing the fish scales and fossil plants proves the presence of luxuriant vegetation in swamps, or lakes. This conclusion is still further verified by the occurrence of thin coal lenses and numerous casts of limbs.⁷

The maximum thickness of the continental deposits of the Trias in southeastern Pennsylvania is estimated at 20,000 feet. The material contained in them is poorly washed and assorted; this is illustrated by the occurrence of arkose sandstones and conglomerates in the formation.

In York County, the Triassic beds, excepting the igneous rocks,⁸ consist mainly of red, micaceous sandstones, conglomerates and interbedded layers of shales. The sandy layers, with the exception of reptilian tracks, have not as yet yielded fossil remains.

Along the borders of the Little Conewago creek in East Manchester township, there outcrops in several places a layer consisting of hard, nodular, calcareous sandstone. Calculating from the average dip of the rocks, which is approximately 20 degrees, and the horizontal distance, this layer is 6500 feet above the basal conglomerate, exposed in the railroad cut just north of Emigsville. This sandstone is of special interest because in it, or in the shales immediately in contact with it, were found most of the fossils presented in this and in the previous paper.

Plant remains are very irregularly disseminated through this sandstone and its associated shale layers. Sometimes their accumulation in a thin seam causes the rock to part somewhat easily

⁵ L. F. Ward. Status of the Mesozoic floras of the United States. U. S. Geol. Survey, 20th Ann. Rept., p. 255, 1898-99.

⁶ R. S. Lull. Triassic life of the Connecticut Valley. Geol. and Nat. Hist. Survey of Conn., Bull. 24, p. 20, 1915.

⁷ E. Wherry. Silicified wood from the Trias of Pennsylvania. Acad. Nat. Sci. Proc., Phila., 1912.

⁸ F. Ehrenfeld. A Study of the Igneous Rocks at York Haven and Stony Brook, Pa. and their Accompanying Formations. Phila., 1899.

along the plane of deposition and gives to this area a darker color. At one locality rapid transition to the shale above is through a thin, friable layer, black with unrecognizable but undoubted plant remains. Plant impressions, not only in this instance but generally, are very fragmentary, mixed, and evidently made by material much decomposed, or badly macerated by water transportation. Occasionally small portions of stems and twigs are carbonized.

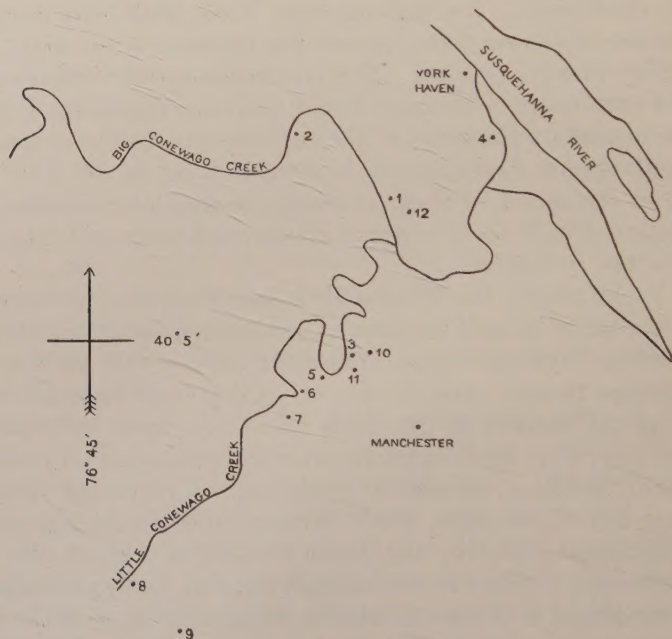


Fig. 1. Localities of Triassic exposures.

The greater the plant impregnation, the more plentiful are the faunal remains. But this statement must not be interpreted to mean that faunal remains are plentiful; the reverse is the case. However, every outcrop of this rock was productive after persistent search. In it were found bone fragments, teeth, fish scales, some casts of saurian dermal plates, and coprolites. The known outcrops of this rock are plotted on the following map, outlined from the Middletown Quadrangle, Penna. (U. S. Geological Survey).

In order to obtain some data as to the possible origin of this

sandstone, a chemical analysis and some thin rock sections of it were made. The analyses of two samples follow:

Sample	Ca CO ₃	Si O ₂	Ca ₃ (PO ₄) ₂
A	56.2 per cent	31.1 per cent	.3 per cent
B	42.3 " "	47.1 " "	.2 " "

The rock sections show it to be a nodular sandstone, cemented together by calcium carbonate. It contains considerable mica, hematite, and some feldspar and clay. The maximum thickness of the layers is two feet. There is a rapid transition above and below to shale.

The origin of this rock presents an interesting problem. It was formed, probably, by the accumulation of material in a shallow lake, swamp, lagoon or estuary. The decay of the vegetable matter under water, in some cases, has caused complete carbonization of the thicker stems, resulting in thin coal lenses. The quantity of carbonaceous impregnation points to a somewhat luxuriant growth of ferns, rushes and cycads. The limestone content, probably, was deposited by evaporation or by chemical precipitation. In swamps, plant decomposition may have accelerated this precipitation.

Evidence suggesting that this rock was formed under saline rather than fresh-water conditions was found by the writer. On one of the shells of *Diplodon yorkensis*, a fresh water mollusk, were found the coiled shells of *Spirorbis inexpectatus*. Dr. J. M. Clarke, reporting on this find, stated: "You will notice that with the coiled shells are little ostracodes which are also indicative of brackish-water conditions." The presence of these two types of marine fauna attached to the shell of a fresh-water species suggests the conclusion that the continental sediments forming this layer of rock were deposited in a body of water that had some connection with the sea. That this body of water was shallow, is further proven by the imprints on the sandstone of reptilian tracks, rain drops and ripple marks. The material may have been deposited in a shallow, brackish, or salt-water lake or a tidal estuary, or mud flat. The above conclusion is drawn from the fact that *Spirorbis* and some ostracodes belong to marine and not fresh-water fauna. The stratigraphic evidence in this region points rather to fresh than to salt-water deposition.

REPTILIAN REMAINS

Part of a jaw, (Plate III, figs. 1 and 1a) was found in a black shale along the Little Conewago creek (loc. 3). The fossil when uncovered terminated at a break in the posterior end of the jaw, so that the full length of the original cannot be determined. At intervals along the bone are depressions, marking sockets from which the teeth have been lost. Projecting from the anterior end is part of a tooth; though fragmentary and in poor condition, enough is preserved to identify the specimen as a lower premaxilla of a *phytosaur*, *Rutiodon carolinensis* (Emmons).⁹

The identification of *Rutiodon carolinensis* from the Trias of Pennsylvania was based on a rib and some isolated teeth found in the Phoenixville tunnel. These were described by E. D. Cope and classified by him under the name of *Belodon lepturus*. Subsequently, they were referred by F. von Huene¹⁰ to *Rutiodon carolinensis*. Measurements:—Total length of specimen, 25.5 cm. Maximum width, 22 mm. Minimum width, 13 mm.

In this same black shale were found coprolites, fish scales, impressions of *Estheria ovata* and *Candona rogersi*.

The rib of *Rutiodon carolinensis* (Plate III, fig. 2) was found in the nodular sandstone (loc. 6). A short section is missing, but otherwise it is well preserved. Its curvature is pronounced. Total length of rib, 30 cm.

In the transition layers of shale, associated with the rib, fragmentary plant remains of the following species were identified: *Macrotanopteris magnifolia*, *Cheirolepis muensteri* and *Palissya sphenolepis*.¹¹

Two teeth (Plate III, figs. 5 and 6) are similar to those described by W. J. Sinclair, and are probably teeth of *Rutiodon manhattanensis*.¹² The other specimens (Plate III, figs. 3 and 4) are probably teeth of *Rutiodon carolinensis*. All were found encased in the nodular sandstone (locs. 5, 8, 10 and 11).

⁹ J. H. McGregor. *Phytosauria*. Mem. of Amer. Mus. Nat. Hist., Vol. IX, Part II, p. 95, Pl. IX, Figs. 39 and 39A, 1906.

¹⁰ F. von Huene. Reptilian and Stegocephalian Remains from the Triassic of Pennsylvania in the Cope Collection. Bull. Amer. Mus. Nat. Hist., Vol. XLIV, Art. XIX, pp. 561-574, 1921.

¹¹ A. Wanner. Triassic Flora of York County, Penna. Ann. Rep. U. S. Geol. Survey 1898-99, pp. 238-253.

¹² W. J. Sinclair. A large Parasuchian from the Triassic of Pennsylvania. Amer. Jour. of Science, Vol. XLV, 1918.

	Length of tooth	Diameters at base of tooth ¹³
Fig. 3	15 mm.	13 and 8 mm.
" 4	27.5 mm.	7 and 5 mm.
" 5	48 mm.	12 and 10 mm.
" 6	31 mm.	22 and 15 mm.

CRUSTACEANS

Estheria mangaliensis pennsylvanicus new subspecies. Text-fig. 2.

The shape of the carapace valves varies from subovate to subtriangular to suboblong. Individuals differ in size. The number of ridges of growth varies from 8 to 17, according to age. They are more clearly defined and more widely spaced than those of *Estheria ovata*. This is indicative of a somewhat thicker and heavier shell. The hinge line terminated in front by the umbo is well defined. The length of the hinge line, in some specimens, is about one-third that of the valve; in other specimens its length is nearly one-half the length of the valve. Length, varies from 5 to 5.5 mm.; height, varies from 3.4 to 3.7 mm. Diameter, appears to be less than 1.5 mm.

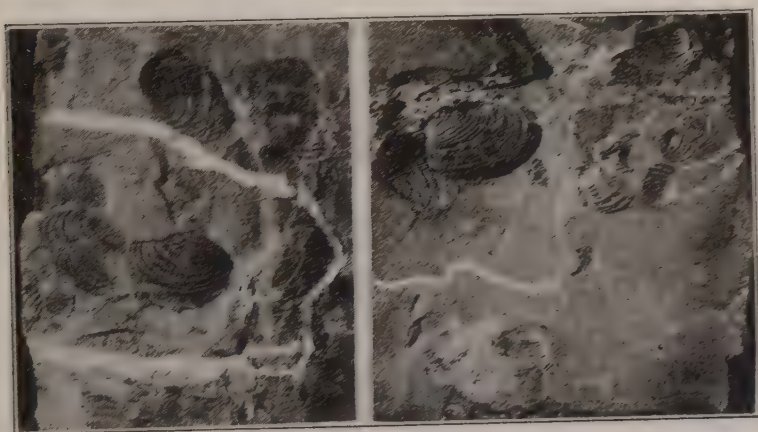


Fig. 2. *Estheria mangaliensis pennsylvanicus*.

The shells of this *Estheria* are so similar in their character to those of *Estheria mangaliensis*,¹⁴ from the Upper Triassic of Central India, that they are referred to this species. However, since this crustacean has never been found in America, the writer feels

¹³ The transverse diameters are merely approximates as the teeth are partly imbedded.

¹⁴ T. R. Jones. A Monograph of Fossil Estheria. Palaeontographical Soc., pp. 78-81, Pl. II, figs. 16 to 23, 1862.

warranted in assigning it to a separate variety, namely *Estheria mangaliensis pennsylvanicus*. The collection of more specimens and further investigation may prove this to be a distinct species.

These fossils may be of some value in correlating the age of the Upper Triassic beds of Pennsylvania with those of Central India.

The *Estheriæ* were found in scattered masses, some broken and others well preserved, in a thinly bedded, light-green shale along the Big Conewago creek (loc. 12). The habitat was fresh water, as they are associated with the shells of fresh water mollusks and plant and reptilian remains.

MOLLUSCA

(Contributed by H. A. Pilsbry)

Numerous specimens of unionid mussels collected in the past year appear referable, with one exception, to the species described in a former paper. One species represented by several specimens seems to be new; but description and illustration are deferred in the hope of finding better material.

The following forms are referred to Dawson's genus *Naiadites* with some hesitation. Their hinges are not accessible in the material found so far, and a reference based upon external similarity, though not without precedent in palæontologic literature, offends my instincts as a zoologist. *Naiadites*, from the Coal Measures of Nova Scotia, is far earlier than the fossils we are dealing with. However, the superficial similarity is great, and I have found no genus which appears more appropriate for these fossils.

Naiadites triassicus new species. Text-fig. 3.

Locality 3, associated with *Diplodon*, but more abundant, and in better preservation in the layer immediately above, where *Diplodon* becomes rare. Type No. 12501 ANSP.

The shell is subtriangular, strongly convex, with nearly terminal beaks and straight hinge line. The posterior-basal extremity is broadly rounded, the basal margin is nearly straight in the middle, and the long posterior-upper slope is slightly convex. The surface has numerous fine ripples of growth and some deeper furrows along growth lines; there are also several irregular radial raised lines, perhaps the result of compression.

Greatest length 5 mm., width (at right angles to the longest axis) 3.45 mm.

Many specimens were found.

Naiadites wanneri new species. Text-fig. 4.

Locality 3. With the preceding species. Type No. 12502 ANSP.

The shell appears to be relatively narrower than *N. triassicus*, and differs by the finer, rather even sculpture of fine, close, sharp growth striæ, beautifully decussated by very fine, very close, raised radial striæ. Length 3.8 mm.

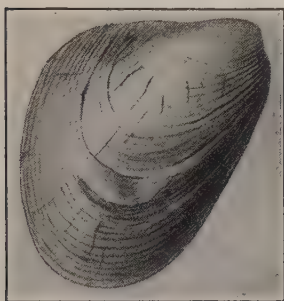


Fig. 3. *Naiadites triassicus*.

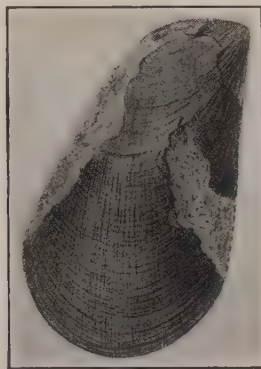


Fig. 4. *Naiadites wanneri*.

As the dorsal outline of the type is quite imperfect the width cannot be stated. This form appears to be rare.

SUMMARY OF THE FAUNAL REMAINS FOUND IN THE TRIAS OF YORK COUNTY, PENNSYLVANIA

The numbers in the last column refer to: 1, my paper in these PROCEEDINGS for 1921, and 2, the present paper.

		Paper
Reptilian tracks:	three new types	1
Reptilian remains:	rib, jaw and teeth of <i>Rutiodon carolinensis</i> (Emmons);	2
	teeth of <i>Rutiodon manhattanensis</i> von Huene	2
Crustaceans:	<i>Estheria ovata</i>	
	<i>Candona rogersi</i>	
	<i>Estheria mangaliensis pennsylvanicus</i> , n. var.	2

		Paper
Fish:	Ganoid scales, sp. undet.	1
Annelids:	<i>Spirorbis inexpectatus</i> , n. sp.	1
Mollusks ¹⁵ :	<i>Diplodon pennsylvanicus</i> , n. sp.	1
	“ <i>borealis</i> , n. sp.	1
	“ <i>wanneri</i> , n. sp.	1
	“ <i>carolussimpsoni</i> , n. sp.	1
	“ <i>yorkensis</i> , n. sp.	1
	<i>Mycetopoda diluculi</i> , n. sp.	1
	<i>Naiadites triassicus</i> , n. sp.	2
	“ <i>wanneri</i> , n. sp.	2

EXPLANATION OF PLATE III

Fig. 1.—*Rutiodon carolinensis*. Lateral (outside) view of right ramus of mandible, somewhat reduced.

Fig. 1a.—The same, viewed from above.

Fig. 1b.—The same, cross-section at point marked x.

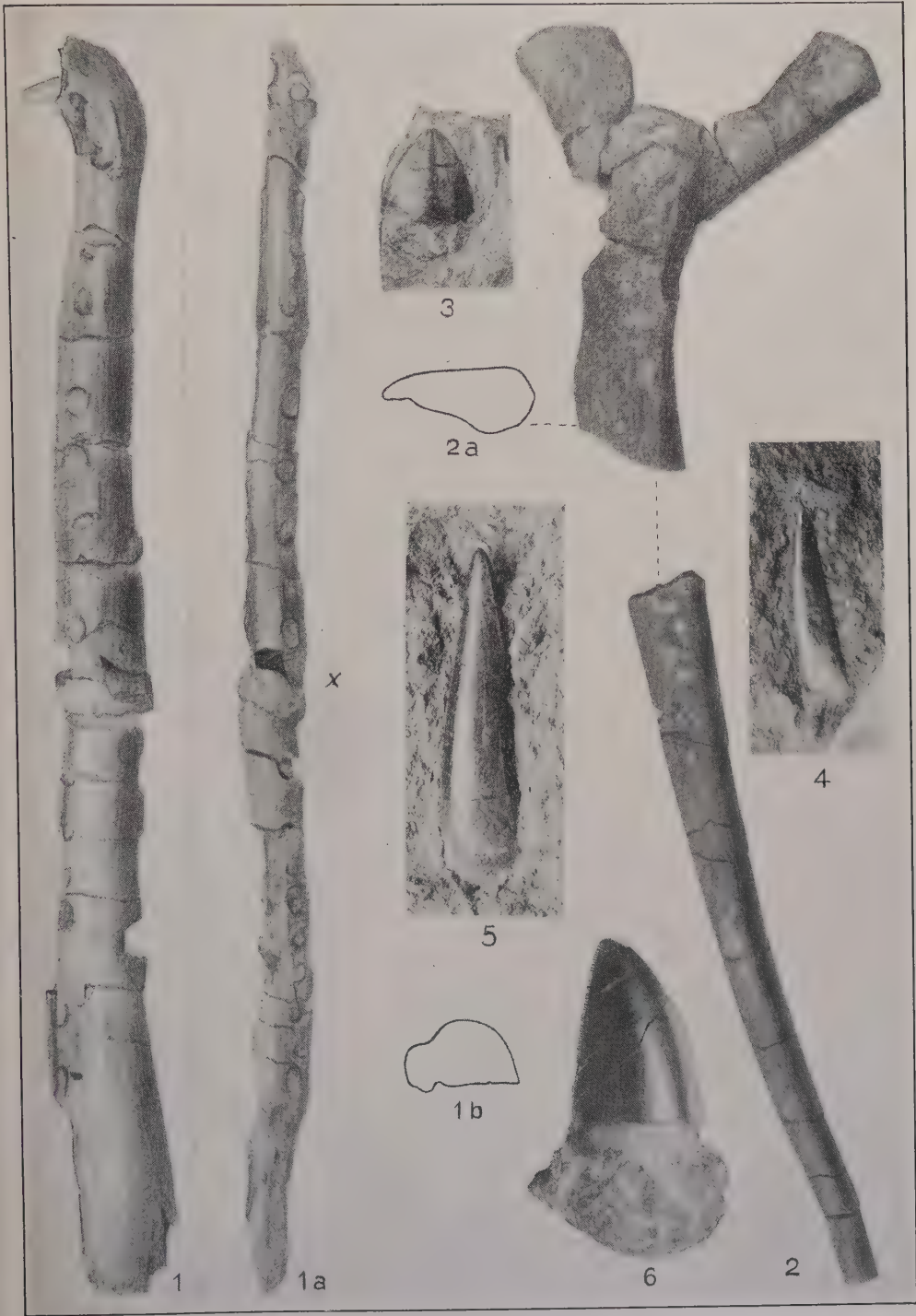
Fig. 2.—*Rutiodon carolinensis*. Two pieces of a rib, somewhat reduced.

Fig. 2a.—Cross-section of same at break.

Figs. 3, 4.—*Rutiodon carolinensis*. Teeth, natural size.

Figs. 5, 6.—*Rutiodon manhattanensis*. Teeth, natural size.

¹⁵ Found by the author but identified and described by Dr. H. A. Pilsbry.



WANNER: FAUNAL REMAINS FROM TRIAS OF YORK COUNTY, PENNSYLVANIA.

